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Time-Temperature Superposition Applied to PBX Mechanical Properties DARLA THOMPSON, RACCI DELUCA, WX-7, Los Alamos National Lab — The use of plastic-bonded explosives (PBXs) in weapon applications requires a certain level of structural/mechanical integrity. Uniaxial tension and compression experiments characterize the mechanical response of materials over a wide range of temperatures and strain rates, providing the basis for predictive modeling in more complex geometries. After years of data collection on a wide variety of PBX formulations, we have applied time-temperature superposition principles to a mechanical properties database which includes PBX 9501, PBX 9502, PBXN-110, PBXN-9, and HPP (propellant). The results of quasi-static tension and compression, SHPB compression, and cantilever DMA are compared. Time-temperature relationships of maximum stress and corresponding strain values are analyzed in addition to the more conventional analysis of modulus. Our analysis shows adherence to the principles of time-temperature superposition and correlations of mechanical response to the binder glass transition and specimen density. Direct ties relate time-temperature analysis to the underlying basis of existing PBX mechanical models (ViscoSCRAM). Results suggest that, within limits, mechanical response can be predicted at conditions not explicitly measured. LA-UR 11-01096.

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